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ABSTRACT

The report describes activities and accomplishments of a project examining facilitative effects of manual signs on oral language comprehension of communication disordered but normal hearing students. The initial section details background and pre-grant studies leading up to the project effort. Studies touched upon such aspects as presentation modality efficiency, sign translucency, and use of unaided nonspeech communication with this population. The second section addresses the findings of the project, which considered the appropriate methodology for the study of sign learning, iconicity (relationship between the sign and its referent), and the manner of presentation of the stimulus sign (including paired-associate studies investigating the effects of presence or absence of sign on learning). The third section describes a shift in emphasis within the project to include mentally retarded populations and presents a list of the status of specific project components. Reports on dissemination activities conclude the document. (CL)

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NON-SPEECH COMMUNICATION

# STUDIES OF FACTORS AFFECTING THE FACILITATIVE EFFECTS OF SIGNING WHEN USED AS AN AID TO COMMUNICATION DEVELOPMENT IN PERSONS HAVING SEVERE COMMUNICATION IMPAIRMENTS BUT ESSENTIALLY NORMAL HEARING

--OSERS GRANT #G007902256 FINAL REPORT--

December 1982

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This final report is comprised of the following sections: 1) background and pre-grant studies and papers leading up to the work being done in the current funding period, 2) activities during the three year present funding period, 3) final status of the various components of the original proposal, ongoing studies, and some projections and other studies that are an extension of this research project, 4) comments about dissemination, and 5) references.

## BACKGROUND AND PRE-GRANT STUDIES AND PAPERS[2]

The present grant is for a three year research project focusing on several aspects of manual signs used to facilitate communication development. The research grant from the U.S. Department of Education Office of Special Education and Rehabilitation Services (OSERS) covered the period of September 1, 1979 through November 30, 1982

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[1]The project co-directors wish to express their deepest appreciation to the many staff members and students who so generously gave their time and expertise to this project. Elizebeth Mlcoch and David McGraw were particularly helpful in preparing the 01 and 02 year progress reports respectively.

[2]This section is similar to the same section of the 1980 and 1981 progress reports. It is included to provide a context for the new reader.

(this includes a three-month extension without any additional funds). The first year of this project involved recruiting and orienting staff, and effecting a smooth transition from pre-grant studies. These pre-grant studies were conducted as limited student research projects using undergraduate research trainees who received on-the-job training and graduate students who did this work as part of their courses and/or thesis research.

As indicated in the BACKGROUND AND PROCEDURES sections of the original proposal, the co-directors had begun investigating various aspects of nonspeech communication, with limited funding from Purdue University prior to the awarding of the grant, and had raised several questions regarding manual communication. One study (Antunes, 1978; Antunes & Fristoe, 1978) investigated the use of manual signs to facilitate paired-associate (P-A) learning. The results of this study led to additional studies and served to stimulate interest in various aspects and properties of manual signing.

During this same grant period, other related studies were initiated by the project co-directors and several interested doctoral students. One of the first studies falling into this category, an investigation of the transparency of manual signs, was begun by the co-directors in 1977 (Lloyd & Fristoe, 1978, in preparation). A sign is considered transparent if the visual relationship between its formational properties and its referent is readily apparent (Lloyd & Fristoe, 1978, in preparation). The purpose of this study was to determine whether a difference in the transparency of signs is a significant factor in their learnability, and if so, whether this applies to both handicapped and non-handicapped populations. The stimuli consisted of 200 ASL signs, 100 of which were selected randomly by Hoemann (1975) from a group of 500 basic signs. We have referred to these as the General Sign List. The remaining 100 signs, referred to as the Basic Sign List, were those appearing most frequently in 20 sign language manuals for use with severely impaired persons (Fristoe & Lloyd, 1977c, 1979c). For the purpose of this study, normal college students were used as subjects. Results supported the hypothesis that the signs of the basic vocabulary used with individuals with severe communication disorders are more transparent than a sample of ASL signs in general (Lloyd & Fristoe, 1978). The findings led to a similar study on translucency of manual signs used with individuals having severe communication impairment. This study was undertaken by a doctoral student along with the project co-directors (Page, Fristoe, Lloyd, & Dickman, in preparation). Translucency, another aspect of iconicity, refers to the ability to perceive a relationship between a sign and its referent when an individual is shown the sign and told its meaning. In this study a five-point rating scale was used to obtain translucency ratings on the 200 signs that were used in the transparency study. Normal college students rated signs from the Basic Sign List as more translucent than those from the General Sign List (which is consistent with the transparency study findings).

As a result of these studies, and from the information reviewed in the original proposal, it was felt that there was need for translucency ratings on a larger sign pool for the purpose of controlling for translucency in subsequent studies. Therefore, two doctoral candidates, under the direction of one of the co-directors, developed a larger list of signs for a seven-point rating. Subjects in this experiment were shown manual signs and asked to rate how closely the form of each sign was related to its meaning, as represented by an English gloss. The results of this study produced translucency ratings on 782 words (Luftig, Page, & Lloyd, 1981; 1982)

Another study begun prior to receiving funding, was conducted by several doctoral students interested in the use of manual signs in a study of presentation modality efficiency. This study (Lloyd, Luftig, Gauthier & Freeman, 1979; Luftig, Gauthier, Freeman & Lloyd, 1980a, 1980) presented the stimulus term sequentially either in the same modality (sign-sign, auditory-auditory and graphic-graphic) or in two different modalities (graphic-oral, graphic-sign and oral-sign) in a P-A task. Subjects were normal college students. Results suggested that the sign-sign condition led to better learning when compared with other possible combinations (Lloyd, et al., 1979; Luftig, et al., 1980a, 1980b).

In addition to the studies discussed, Page conducted a doctoral dissertation investigating developmental and experiential aspects of sign translucency. Briefly, this study yielded translucency ratings on a group of 45 ASL signs representing three syntactic classes (action, nomination, and attribution). The data were collected from normal subjects of three age groups (4 year olds, 7 year olds, and adults) to investigate the effects of linguistic and cognitive development on the ability to perceive a relationship between a sign and it's referent. The two groups of children and one adult group used a 3-point rating scale; the second adult group used a 5-point scale. She summarized her findings as follows: "Results of a chi square analysis indicate that both child groups gave more signs the highest translucency rating than adults did.... Ratings of half of the signs show significant intergroup differences.... Several additional statistical measures provide evidence for intergroup similarity." From this Page "concluded that it may be appropriate to use adult ratings to select iconic signs for children's sign training. Analysis of simple main effects for sign class at each age group and corresponding Newman-Keuls probes indicate that subjects in each group rated action signs highest, nomination second highest, and attribution signs lowest.... Several statistical measures indicate a high degree of similarity between relative ratings provided by adults using 3- and 5-point scales. It is concluded that the size of the rating scale does not significantly alter either the ratings of a sign relative to the other signs or its absolute rating relative to the size of the scale." (Page, 1981, pp. xii-xiii)

In addition to the above studies and projects, the co-directors also completed several related papers during the grant period. A brief discussion of each follows.

"Non-Speech Communication" (Fristoe & Lloyd, 1979) was published in the revised edition of N. R. Ellis' Handbook of Mental Deficiency: Psychological Theory & Research. This chapter presents an overview and analysis of the many aided and unaided systems of nonspeech communication, including American Sign Language, the various pedagogical sign systems such as Signed English, Blissymbolics and Rebus. Sixteen possible reasons for the effectiveness of nonspeech systems are presented to serve as a stimulus for research. Suggestions to aid in the selection of candidates for a nonspeech communication program along with a discussion on selection of clients and systems are also included. The final section of the chapter deals with various aspects within the area of nonspeech communication which require further research.

Using cognitive and psycholinguistic developmental data, Fristoe and Lloyd (1980) discussed strategies to be used in planning an initial expressive sign lexicon of approximately 50 signs (the approximate size of a child's expressive vocabulary when two-word phrases emerge, a significant linguistic development). The authors applied these guidelines to the most frequently occurring items in vocabularies found in 20 manuals designed for use with retarded and autistic individuals who were being taught to communicate through the use of manual signs (Fristoe & Lloyd, 1977, 1979b). A suggested sign lexicon is presented along with information as to which signs were found to be most iconic in the transparency study outlined earlier (Lloyd & Fristoe, 1978, 1980a).

An extensive bibliography on unaided nonspeech communication for severely handicapped persons was also prepared (Lloyd, 1980b). Briefly, this paper reflects the growing interest in the use of nonspeech communication, particularly unaided systems, with retarded and other individuals with severe communication impairment not primarily due to hearing impairment (Lloyd, 1980b). Factors explaining this growth are discussed. While a marked increase in the use of unaided nonspeech communication by professionals is apparent, it was also apparent to the author that most individuals using such a system were unaware of similar work being done by their peers, as had been pointed out by Fristoe in 1975. Therefore, the resulting bibliography was an attempt to provide a resource for all those interested in using unaided nonspeech systems.

Also, a project started prior to funding but submitted and accepted for publication during the grant period is an article entitled, "Signs Used in Manual Communication Training With Persons Having Severe Communication Impairment" (Fristoe & Lloyd, 1979b). This is a compilation of sign vocabularies, including the frequency with which each sign occurred in 20 manuals. This compilation serves a wide variety of clinical and research purposes.

ACTIVITIES OF THE GRANT PERIOD

The work described above was begun prior to the awarding of the grant and was largely the result of a growing interest of the co-investigators and their students in the field of nonspeech communication. A number of the papers cited above were completed during the grant period and provide a critical base for the current research (Fristoe & Lloyd, 1979b, 1980; Luftig, et al, 1980a, 1980b, 1981, 1982; Page, 1981). Since the awarding of the grant, activities have focused on determination of appropriate methodology for the study of sign learning, that is, which experimental design or designs are best suited to investigate the areas proposed in the grant. The second focus has been on iconicity, i.e., the relationship between the sign and its referent. This includes transparency, i.e., is the sign meaning readily guessed because it resembles very closely the object or action for which it stands? This also includes translucency, i.e., is the sign-referent relationship readily apparent to a subject once the relationship is revealed? The third area of focus has been on the manner of presentation of the stimulus sign, variations upon stimulus presentation, and paired-associates (P-A) studies investigating the effects of presence or absence of sign on learning.

A series of P-A studies has been undertaken. One of these studies involved an investigation into the area of translucency of signs and the concreteness of referents (Lloyd & Luftig, 1980; Luftig & Lloyd, 1980, 1981). The translucency ratings used in this study were derived from the previous study on the translucency of manual signs (Luftig, Page & Lloyd, 1981). The concreteness ratings were taken from the article "Concreteness, Imagery & Meaningfulness Values for 925 Nouns" (Paivio, Yuille, & Madigan, 1968). Sixty adult subjects were assigned randomly to one of four experimental conditions. The four conditions were: High Translucency/High Concreteness, Low Translucency/Low Concreteness, High Translucency/Low Concreteness & Low Translucency/High Concreteness. In this study, each subject was asked to learn fifteen ASL signs and their English glosses in a paired associates format. The manual sign appeared on the screen, followed by a brief interval (2 seconds) in which the screen was blank, and the subjects had an opportunity to guess the corresponding item before it appeared. Following this interval, the graphic representation of the English gloss of the sign was presented on the screen for 2 seconds, providing feedback to the subject as to whether or not the response was correct (Lloyd & Luftig, 1980; Luftig & Lloyd, 1980, 1981).

In addition to this study, the co-directors completed a series of three P-A learning studies which were reported at the 1979 ASHA Convention. Evidence suggests that subjects' high rate of performance when signs were present was due in part to the mediational role played by the manual signs and in part to the iconic information present in the signs themselves. Instructions to a group of subjects to use the signs as mediators did not increase level of performance over that found in subjects who received no direct instructions concerning signs. To study recovery of performance after the signs were no longer present, three-trial, removal and four-trial, removal experiments were designed. The results suggest that general instructions to

use signs as a learning aid did not increase performance over that observed when subjects were left to discover this on their own. After signs were no longer available, performance on those items which had previously been accompanied by signs was temporarily depressed, but improvement occurred at a faster rate than on stimuli which had never been accompanied by signs. The major cautions in the interpretation of these results are: 1) more specific instructions may have produced different results and 2) handicapped subjects may perform differently. In addition, because Fristoe and Lloyd (1979) selected these items from a basic set of 100 signs occurring most frequently in manuals for severely handicapped persons (Fristoe and Lloyd, 1979) and these have been shown to be more transparent than a random sample from the entire sign set (Lloyd & Fristoe, 1978), it is not possible to attribute the results obtained to either stimulus presentation or stimulus processing factors. Luftig et al. (1980) effectively controlled for the effects of iconicity my mismatching the signs with the referent pictures; this was done by randomly reassigning signs to referents. This would suggest that, apart from the representational possibilities, manual signs are effective facilitators because of their being in the same mode (visual) as the referent picture unlike the spoken cue which is in the auditory mode. But, because all three studies (Antunes & Fristoe, 1978; Fristoe & Lloyd, 1979; Luftig et al., 1980) used known, common referents, the results can only be interpreted as supporting the facilitative effects of manual signs upon recall when response forms and part of the associates (the picture) are highly familiar material that could allow covert mediation.

Therefore, a final study (Karlan, Lloyd & Fristoe, 1983) was undertaken to determine whether or not the facilitative effects of signs would obtain when referents were unknown to subjects. Further, the abstract referents being paired with conventional Signed English signs (Bornstein, Hamilton, Saulnier & Roy, 1975) eliminated iconic relationships between the sign and the referent and allowed the question of whether facilitation is a function of stimulus modality to be examined. Finally, a training-to-criterion comprehension task was used to more closely approximate the task to which the handicapped populations are typically exposed.

The primary question of interest was whether comprehension was facilitated by the presence of manual sign cues, either alone or in combination with oral cues, when the referents are unfamiliar and abstract. The results indicate that there was no facilitative effect. While significant differences from the baseline were found within all stimulus conditions, there was, with only one exception, no significant differences in probe performances between the oral condition and the dual cue (manual from dual, oral from dual) conditions. Thus, with normal adults already possessing oral language skills, the use of dual oral and manual, so called simultaneous communication, cues did not facilitate the acquisition of oral comprehension when the referents were unknown and highly abstract.

These results are very different than those reported in the earlier paired-associates research with adult populations (Antunes,

1978; Fristoe & Lloyd, 1979; Luftig, Gauthier, Freeman & Lloyd, 1980). Antunes (1978) and Fristoe and Lloyd (1979) found that simultaneous cues facilitated performance when compared with the use of oral cues. Luftig, et al. (1980) found that, while manual cue performance was significantly better than oral or dual cue performance during initial learning, there was no final difference among manual cue, oral cue or dual cue performance.

In relation to the research findings of Karlan, Lloyd & Fristoe (1983) an important distinction must be noted. The earlier work used a P-A, anticipatory recall task in which the subject is presented with a nonsense CVC, a manual sign, or both the nonsense CVC and the manual sign; there is then a pause during which the subject attempts to provide the real name for the common referent that is then presented. Learning is, therefore, evaluated based upon second and subsequent trial performances. The present study required the subjects to learn to identify abstract, unfamiliar referents in response to nonsense CVC's, manual signs, or both. Thus, the earlier studies might best be considered to be evaluations of the effectiveness of nonsense oral cues or manual sign cues in facilitating recall of highly familiar material (real names for common referents). The present study more closely examines actual acquisition of new name-referent associates. In this regard, then, manual sign cues would appear to be ineffective in facilitating new learning but do appear to facilitate memory and recall of highly familiar material.

Other research with language-delayed and mentally retarded populations who do not already possess the names for the common referents does not support the ineffectiveness of manual cues in facilitating the acquisition of comprehension of new material (Bricker, 1972; Kohl, Karlan & Heal, 1979). These studies have demonstrated that the use simultaneous manual and oral cues resulted in greater receptive acquisition than did the use of oral cues only. Verbal labeling of signs by mentally retarded children is also significantly effected by the iconicity of the signs (Griffith, 1979; Griffith & Robinson, 1980). The primary difference between these studies and Karlan & Lloyd (1982), apart from the obvious population differences, is the potential availability of some type of visual representation of the referents within the manual signs themselves (iconicity) and the meaningfulness of the referents. In the Karlan, Lloyd & Fristoe (1983) study, iconicity could not be a factor because the Signed English signs were not matched with their actual referents but were assigned to the abstract shapes. Even in assigning the signs to the unfamiliar referents care was taken to eliminate visual similarities between the sign and its abstract referent. In the applied research not only was iconicity present but the iconicity of manual signs typically used with handicapped individuals has been shown to be much higher than that present in the general sign pool (Lloyd & Fristoe, 1978).

Several studies with normal adults have also shown iconicity to be an important factor in the paired-associates recall task. When highly iconic ASL signs were used in comparison with ASL signs having low iconic value, learning within the first two to three trials was

extremely rapid under the high iconicity condition (Luftig & Lloyd, 1981). An equivalent level of learning was reached with low iconicity signs by the seventh trial. Antunes (1978) and Fristoe and Lloyd (1979) used signs typically used with the mentally retarded and found early superior performance for simultaneous manual and oral nonsense cues in comparison to that found with oral nonsense cues. It should be remembered that such signs as a group have inherently higher iconicity (Lloyd & Fristoe, 1979). Luftig, et al. (1980), on the other hand, found that, when low iconicity signs were mismatched to their usual referents, there was no different in performance between the oral nonsense cue and manual sign/oral nonsense cue conditions. In addition, they found that acquisition occurred in the late, rather than early trials.

The conclusion to be drawn from such evidence is that the facilitative effects of manual signs upon oral language comprehension would appear to be based upon the conceptual characteristics of sign related to iconicity rather than upon pure input modality characteristics. Visual representation within the visual stimulus and not merely visual stimuli, serves as a basis for learning enhancement.

An important aspect of the three year research project involved the use of a handicapped population. Pilot studies have been done with mentally handicapped individuals at two separate facilities. A study, similar to an earlier study done with normal adults (Antunes, 1978; Antunes & Fristoe, 1978) was carried out with retarded subjects to determine how best to adapt the current research procedures for use with this population. Since the purpose was to assess the effectiveness of current procedures with the handicapped, the individuals involved in this study ranged from severely to mildly retarded. One important aspect learned is that video-taped stimulus presentations are not as successful as live stimulus presentations in P-A tasks for mentally retarded persons. The results of these pilot studies were used to modify the experiments with retarded persons.

Several of the pilot studies with handicapped subjects investigated the effects of various combinations of the simultaneously presented visual stimuli (manual sign and picture pairs) and an auditory stimulus (nonsense word). Included were five combinations of stimulus terms and response terms presented simultaneously and the amount of information being presented was varied across study and test items. As a result of the analysis of the pilot data, a sixth condition was added to the design. Subjects were presented with a familiar object paired with an unfamiliar spoken nonsense label, a sign, or both. Testing involves presenting the subjects with a syllable, a sign or both. The subjects must select the correct

picture, the one that was paired with the stimulus on the study trials. The six conditions are summarized below:

| | Stimulus Terms* (Study Items) | Response Terms* (Test Items) |
|---|---|---|
| 1. | SIGN/nonsense word | SIGN |
| 2. | SIGN/nonsense word | Nonsense word |
| 3. | SIGN/nonsense word | SIGN/Nonsense word |
| 4. | SIGN | SIGN |
| 5. | Nonsense word | Nonsense word |
| 6. | Nonsense word | SIGN |

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*Pictures serve as the referent or association in the study items. In the test items the subject selects the appropriate picture as the response.

The results of these pilot studies, with the first five conditions, showed a clear advantage when signs were present on the test, regardless of whether or not they had been present on the study trials, suggesting that subjects are not learning the pairs so much as "reading" the perceptual information (iconicity) available in the signs. For the sixth condition, subjects were trained with nonsense syllables only and tested with signs only. Better performance on this condition than on those in which testing included only nonsense syllables, may be considered support for this hypothesis.

For the study with mentally retarded subjects, the stimuli were presented live. The major advantage of live presentation for mentally retarded persons, rather than a video-taped presentation, is the flexibility allowed by such a manner of presentation. Training time can be adjusted to each individual rather than be locked into just the training time allowed by the videotape.

Results of this study (Karlan & Lloyd, in preparation) with eight moderately retarded adolescents and eight moderately retarded adults indicate that comprehension recall is substantially facilitated by the presence of sign, alone or in combination with oral cues. The results from the sixth condition, in effect a test of iconicity, indicate that iconic information is used by these retarded individuals and yields better performances than that obtainable under oral cue conditions even when the opportunity for study is afforded. These data also suggest that procedures that highlight or enhance the iconic representation available in signs should prove to be beneficial to efforts to train both comprehension and production skills with severely handicapped children.

George R. Karlan, while assistant professor at the University of Illinois at Champaign-Urbana, served as a consultant in the 02 year. Karlan's contribution has led to the Karlan, Lloyd & Fristoe (1982) study in which 15 college students were trained in a P-A task using

non-meaningful sign, nonmeaningful shapes and nonsense words, either in sign only, word only or a combined condition reported earlier. Karlan subsequently joined the project during the 03 year as Research Co-ordinator. Collaborating with Lloyd, he has continued the research into modality and iconicity effects, has contributed to the extension of the transparency and translucency data pool, and has contributed to the gestural work described below.

The Lloyd and Karlan collaboration has also explored two areas that extend the lexicon work as proposed in the original BEH grants: 1) validation of the Fristoe-Lloyd lexicon (1980a) by having practitioners rate the lexicon signs, 2) investigation of the basic vocabulary needed by adolescent/young adult non-speaking MR persons. These investigations have resulted in a major presentation at the annual conference of the Association for the Severely Handicapped as well as a two-part paper relating to selection of first lexicons and representing the first lexicon with manual sign and gestural symbols (Karlan & Lloyd, in press-a, in press-b). Information concerning selection criteria and conceptual, representational and motoric considerations are discussed with all available empirical information concerning iconicity and motoric demands being integrated relative to sample lexica for children and adolescents and adults.

In addition to the P-A studies that have been discussed, a study of various dimensions of manual signs is also being done. A collection of all known versions of the 326 most frequently appearing signs, taken from the Fristoe and Lloyd (1979b) study "Functional Vocabulary Used in Sign Communication Training With Persons Having Severe Communication Impairment," was compiled from a large assortment of sign books. This is being used to select forms of signs to be used in our studies. One copy was sent to the New England Sign Group, which attempted to provide an analysis of several aspects of the iconicity of the signs. A similar analysis was done on the 782 sign pool and the source of each sign was identified. This analysis served to code various dimensions of manual language such as one handed vs. two handed signs, contact vs. no-contact signs, and same motion vs. reciprocal motion. This information will be used in the experiments designed to examine the effects of variations in these parameters on learning of signs.

Physical aspects of signs is also an important area of research in this project. We completed two major studies in this area. Using normal subjects Langlois (1982; Fristoe & Langlois, 1982) found a slight advantage of two-handed signs over one-handed signs while Lloyd and Doherty (1982a, 1982b, 1983) found an advantage of contact over non-contact signs. Doherty and Lloyd (in progress) have extended this contact vs non-contact (along with translucency) to retarded subjects. This research along with that conducted by others will play a significant role in the direction of our future research. Specifically, the co-directors and related staff will be interested in following the progress of Bornstein's analysis of the critical dimensions of sign comprehension (Bornstein & Jordan, 1980, 1981). Furthermore, Wilbur and Shane (1980, Shane & Wilbur, 1980) have outlined a method for predicting expressive sign capability, based on

motor ability which will also contribute to the future studies of the project. The results of these studies may serve to determine the direction of some of our research and the future analysis of signs.

The investigation into the relationship between a sign and its referent has resulted in the establishment of a pool of signs for which translucency ratings have been determined (Luftig, Page & Lloyd, 1981, in press). From this pool of signs, the basic lexical units can be drawn with which to begin a program of nonspeech intervention. Moreover, these ratings have already been used in our research for such purposes as a matching or controlling variable, as a dependent variable and for comparison. However, there were two basic problems with the Luftig, Page, and Lloyd (1981, in press) translucency ratings of 800 signs. The first was that even though we used a fluent signer to prepare the stimulus tapes there were a number of signs that were difficult to verify in common sources (e.g., Stokoe, et al., 1976; Bornstein, et al., 1964; O'Rourke, 1973). This makes it difficult for others to use the translucency ratings on all of the signs since the production of the sign may vary considerably from the commission researchers' usual production of the signs. This could of course be corrected by using a signer that was fluent in one of the more common sign systems. The second problem relates to the future use of the translucency ratings in clinical/educational applications and research with the severely handicapped. The signs were selected by the first two authors for use in other research projects and this resulted in a large number of fairly esoteric referents (at least referents that would not commonly be used with the severely handicapped). Only about 350 to 400 relatively functional signs that would be applicable to work with the severely handicapped were included. It was therefore decided to extend the translucency project to include a larger group of more functional signs that could be verified (or described) in one of the common sign dictionaries

During the 02 year Lloyd started assembling a list of approximately 900 to 1000 referents that are relatively functional with the handicapped and would potentially serve as a stimulus pool for several years of future research. This selection involves a number of systematic procedures and the assistance of George Karlan (prior to his joining the project as research coordinator) and Richard L. Luftig and a number of other colleagues (including two doctoral students -- Jane E. Doherty and Judy K. Gerard). As a first step the above named individuals reviewed tho 800 signs used by Luftig, et al., and selected those signs they thought meet the objectives of relatively functional and of potential benefit in our future research with the severely handicapped. This resulted in a pool of approximately 400 referents. To this pool the referents used in previously reported research and on-going iconicity research were added (including Goossens', in progress; Page, 1981; Fristoe & Bristow, 1982; Griffith, 1979; Lloyd & Fristoe, 1978; Thrasher, in preparation). This enlarged pool was checked against the 326 most commonly occurring signs in the Fristoe and Lloyd (1977a, 1979) review of sign manuals designed for the severely handicapped. The pool was then checked against the Makaton vocabulary (Walker, 1976) to include all of the signs and stages through eight. Additional referents from

the Karlan and Lloyd survey (in press-a) were added. Finally, Doherty, Gerard, Karlan and Lloyd drew upon their teaching and clinical experience to add a few additional items for a total of 910 relatively common referents (Lloyd & Karlan, in progress).

The 910 referents were used as stimulus tapes to study transparency during the 03 year of the project (Lloyd & Karlan, in preparation). Through Harry Bornstein (Professor of Psychology , Gallaudet College, and developer of Signed English) arrangements were made to videotape a fluent signer in production of the Signed English signs for the 910 items. The signer produced each sign two times in citation form. The tapes developed at Gallaudet were done in alphabetical order and are available to other investigators. (They have already been supplied to James Kahn, Associate Professor of Special Education at the University of Illinois at Chicago for a three-year sign research project he is conducting.)

For the Lloyd and Karlan (in preparation) transparency study the signs were arranged in 10 random order lists of 91 signs each with nine randomly selected items repeated on each tape. Thirty to 40 subjects viewed each of the 10 tapes for a total of 350 subjects. The data have been analyzed and the manuscript is currently in preparation (Lloyd & Karlan, in preparation).

Once data were collected for the transparency study the 10 stimulus videotapes were modified by adding the English gloss for each sign on the lower portion of the screen and an audio dub for each gloss. These modified tapes along with modified data sheets and instructions are currently being used to collect translucency rating data from approximately 350 normal young adults (at least 30 subjects per tape). Data collection should be completed by March, 1983 and we hope to have the analysis and write-up completed by the end of the year (Lloyd & Karlan, in progress).

As a logical extension of this work, the 910 relatively functional referents are being used in a study of the translucency of Blissymbols (Luftig, Lloyd, & Karlan, in preparation). The Blissymbols used in this study are being prepared with the assistance of Shirley McNaughton and the Blissymbolics Communication Institute in Toronto. Luftig, Karlan and Lloyd are also making initial plans to extend the translucency research to collect data on the Rebus symbols used to represent the 910 referents. When these two studies are completed we will have basic translucency data on a large pool of referents for three of the more commonly used nonspeech communication symbol systems as they might be applied to the severely handicapped.

One of the doctoral students (Judy K. Gerard) serving as a research assistant has extended our translucency research with signs to conduct a comparative study of the Makaton variant of British Sign Language signs and ASL signs (Gerard & Lloyd, 1982). She is also developing a dissertation extending our translucency research, which has primarily used the citation form of signs (signs made in isolation), to investigate the effects of linguistic and non-linguistic contextual cues (Gerard, in progress).

Examinations of the transparency of manual signs has almost always been done as an open-set task. Comprehension of words and signs has much in common with closed-set tasks in that the understanding of meaning is based on using a relatively small subset of the comprehender's lexicon and experience. Only one transparency study has been reported in which the design employed a closed-set procedure. This was a study by Bellugi and Klima (1976), in which they provided normal adult subjects with four written words from which to select the best meaning for each sign which was presented. Obviously a format employing written words is inappropriate for use with children and many retarded persons. Therefore, a study (Fristoe & Kienapple, in preparation) was undertaken having as its purpose the creation of a pictorial form of closed-set transparency assessment which could be used with subjects unable to easily understand written words. Closed-set and open-set responses were obtained from 20 normal adults and 20 normal four- and five-year old children to 20 manual signs with a meaning that could be pictured. The foils were two frequently given but incorrect guesses of the meaning of these same signs plus an illustration of a response that sounded like an English gloss for the sign but was unrelated to its meaning. Data have been collected on these populations and are presently being analyzed. The question of practical interest is how well open-set data, much easier to come by, can be used to predict closed-set data in normal adults and normal children, and then how well data from normal children can be used to predict performance of mentally retarded children of the same mental age. This latter question is of particular importance to persons doing research with manual signs because the wide-spread use of manual communication programs with retarded children is making it increasingly difficult to find retarded subjects who have not been exposed to manual sign instruction to some degree.

An extension of the research concerning sign iconicity involved the study of gestures, something not outlined in the original proposal. The literature (Skelly, Schinsky, Smith, Donaldson & Griffin, 1975; Skelly, Smith & Fust, 1974) has indicated that one gesture system, Amer-Ind, is more easily comprehended without prior training than other sign systems such as ASL. Because of this, it has been suggested that Amer-Ind should be the first system chosen for use with mentally handicapped non-speaking persons (Silverman, 1980). Therefore, a series of studies on the transparency (guessability) of Amer-Ind gestures was carried out. The first study (Daniloff, Lloyd & Fristoe, 1983), while showing Amer-Ind to be more easily comprehended than ASL, demonstrated that the difference between Amer-Ind and ASL is considerably less than the literature indicates. It seems that the transparency of Amer-Ind may have been over estimated in previous reports. Based upon this research and her thesis (under the name Kelsch, 1979, but published as Daniloff, Noll, Fristoe & Lloyd, 1982) Daniloff has continued her work with Amer-Ind as a viable approach for use with the retarded (e.g., Daniloff & Schafer, 1981; Daniloff & Vergera, 1982; Lloyd & Daniloff, in press).

In a follow-up of work conducted as part of a Master's thesis directed by Karlan while at Illinois (Karlan & Fiocca, 1982), an

investigation was conducted of the ability of moderately retarded adults to comprehend, i.e., guess, the meaning of gestures thought to be commonly understood by society at-large (Doherty, Karlan, & Lloyd 1982). In the following study, items were presented on videotape that had both Amer-Ind and common gesture forms. In addition to the question of the comparability of these two gestural systems in terms of guessability by moderately retarded adults, the question of the facilitative effects of parlinguistic cues upon guessability was also explored. Paralinguistic here refers to such cues as facial expression exaggeration of movement, bodily posture, etc. which are not inherently a part of the gestural response. This would parallel differences between citation and performance versions of signs or gestures.

There were several corrollary studies conducted that were not directly funded by the grant, but are important to the activities of the grant staff. Two of these studies were conducted by doctoral students in Special Education and were partially supported by OSERS student research grants. Both studies used mentally retarded subjects. Creekmore (1981; Creekmore & Lloyd, in preparation) investigated the effects of a pre-training, general imitation experience on the acquisition of manual signs by severely retarded children. Results indicated that a pre-training period enhanced sign learning and offered some interesting information about training methods (imitation, molding, and combined imitation/molding).

A comparison of the learnability of basic ideographic symbols and manual signs was completed by a masters degree student under the direction of Fristoe. The purpose of the study was to determine if significant differences existed between production of manual signs and identification of basic ideographic symbols (Bristow, 1980, Fristoe & Bristow, 1981).

Goossens', a special education doctoral student, has been investigating the relative ease with which moderately and severely retarded individuals are able to learn manual sign and Blissymbolics when iconicity is allowed to freely vary within an initial functional lexicon (Goossens', in preparation). As a preliminary, she has collected translucency rating data from moderately retarded school-age children.

Some of the important activities of the project were the iconicity studies, the resolution of methodological problems including the method of stimulus presentation when using MR individuals as subjects, and the learning/mediational studies, as well as the integration of the principle investigators' (Lloyd & Fristoe) and the research coordinator's (Karlan) research into the grant activities. In addition graduate and undergraduate students were involved in the grant activities, giving them valuable experience that will serve them well as they begin their independent research after graduation. Although we had some changes in staff (e.g. new research assistants and three different research coordinators --- Mlcoch, McGraw, and Karlan) we feel we have made significant progress on the research projected on the time line in the original proposal (p. 24).

FINAL STATUS OF ORIGINAL COMPONENTS AND PROJECTIONS

Originally the focus of the research effort was with non-retarded individuals. Work with non-retarded subjects continues, but during the last half of the project the emphasis has shifted to MR populations. The conclusions from these studies are now being used to develop teaching strategies for the severely communicatively impaired. This section of the report summarizes the current status of each of the components in the original application at the end of the grant period. Along with an indication studies continuing beyond the grant period this section includes some projections of studies that are a direct outgrowth of this three-year project.

Status of specific components of the project follows. Page numbers refer to the original proposal.

COMPONENT I: Evaluation of Stimulus Presentation Methodology:

I-A-1 Mediation (p. 13): Normal Adults.
Fristoe & Lloyd, 1979, in preparation

I-A-2 Mediation (p. 13): Normal Children.
Pilot studies conducted, may not be necessary to do formal studies, but move on to further work with the retarded (see: I-A-3 and I-B-3).
Bristow, 1980 (production aspects)
Bristow & Fristoe, in preparation

I-A-3 Mediation (p. 13): Clinical Children (see also I-B-3).
Pilot studies at Wabash Center
Pilot studies at Monticello
Pilot studies at New Castle
Decision: go to live presentation

I-B-1 Presentation Mode (p. 14): Normal Adults.
Pilot studies with 5 different stimulus conditions
Karlan, Lloyd & Fristoe, 1983
Lloyd & Fristoe, 1979
Lloyd, Luftig, Gauthier & Freeman, 1979
Luftig, Gauthier, Freeman & Lloyd, 1980a, 1980b

I-B-2 Presentation Mode (p. 14): Normal Children.
5 different stimulus conditions, pilot completed

I-B-3 Presentation Mode (p. 14): Clinical Children.
Pilot studies with 5 different stimulus conditions
Karlan & Lloyd (1982, in progress)

I-C Optimal Time Delays (pp. 14-15): Normal Adults, Normal Children, and Clinical Children. To be conducted later.

Related Studies: Component I
Fristoe & Lloyd, 1979
Fristoe & Zimmerman, 1982
Zimmerman, 1981

COMPONENT II: Stimulus Variables Which Affect Learnability:

II-A Varying temporal duration of the stimulus sign (pp. 15-16): Normal Adults, Normal Children and Clinical Children. To be conducted later.

II-B-1 Determination of Iconicity (p. 17): Normal Adults. A slight change was necessary in the original plan for II-B (Determination of Iconicity). The need for additional transparency studies with normal adults was recognized, and so emphasis was given to this area. Studies in this area are listed below:
Daniloff, Lloyd, & Fristoe, in preparation (plus other related studies on Amer-Ind in progress).
Doherty, Karlan & Lloyd, 1982, in preparation.
Fiocca, 1981
Karlan & Fiocca, 1982
Lloyd & Fristoe, in preparation
Luftig, Page & Lloyd, 1981
Luftig, Page & Lloyd, in press
Lloyd & Karlan, in preparation

II-B-2 Determination of Iconicity (p. 17): Normal Children and Clinical Children. This area was also modified as per the comments in the previous area. The transparency studies for normal children and clinical children are now in preparation (e.g., Gerard). The two Karlan & Lloyd collaborative projects on lexical items combined with previous work (Fristoe & Lloyd, 1980; Luftig, Lloyd & Page, 1982; Luftig, Page, & Lloyd, 1981, in press) also contribute to this area.

II-C-1 Rating of the Relationship of Sign Formation to Referent (p. 18): Normal Adults.
Gerard & Lloyd, 1982, in preparation
Page, Fristoe, Lloyd, & Dickman, unpublished
Page, 1981

II-C-2 Rating of the Relationship of Sign Formation to Referent (p. 18): Normal Children.
Page, 1981

II-C-3 Rating of the Relationship of Sign Formation to Referent (p. 18): Clinical Children.

Page is planning to extend her dissertation to clinical children

Luftig & Lloyd are planning studies with clinical children using a larger group of signs than Page will use.

Goossens' dissertation (with Lloyd and funded by another grant) will also be related to this area

II-D Overt Test of Visual Representation (p. 18): Normal Adults, Normal Children and Clinical Children.

Fristoe & Kienapple, in preparation

II-E Categories of Iconicity (p. 19): Normal Adults. The New England Sign language Society attempted to categorize the signs used in our studies according to the system described by Mandel (1977), which was based on the type of relationship between the sign and its referent. They finally concluded that Mandel's system could not be used for this purpose because many signs fell into more than one category, even though the categories were supposed to be nonoverlapping. The New England Sign language Society concluded that such an attempt should be terminated. Wilbur, consultant at the time and a member of this group, did provide a categorization of both the conversational and the citation form of these signs with regard to whether they involve one or two hands and whether or not they are made with contact or without contact without causing them to be confused with other signs. This information will be of particular use in II-H.

II-F Learnability as a Function of Iconicity (p. 18): Normal Adults, Normal Children and Clinical Children.

Lloyd & Luftig, 1980
Luftig & Lloyd, 1980, 1981
Luftig, Lloyd & Page, 1982

II-F Learnability as a Function of Iconicity (p. 20): Normal Adults, and Normal Children. Because of delays in the 01 and 02 years we decided not to conduct these studies during the grant period. However the Luftig and Lloyd (1981) Study relates to this issue.

II-F Learnability as a Function of Iconicity (p. 20): Clinical Children. We are currently planning studies in this area, but it should also be noted that Goossen's dissertation will also relate to this area of investigation.

II-H-1 Contact and Number of Hands (p. 20): Normal Adults
Langlois, 1982
Langlois & Fristoe, 1982
Lloyd & Doherty, 1982a
Lloyd & Doherty, 1982b
Lloyd & Doherty, in press

II-H-2 Contact and Number of Hands (p. 20): Normal Children, and Clinical Children.
Doherty & Lloyd, in progress

Related Studies: Component II
Daniloff, Noll, Fristoe & Lloyd, 1982

COMPONENT III: Teaching Strategies for the Enhancement of Learnability

III-A Logical and Illogical Explanations (p. 22): Normal Adults, Normal Children, and Clinical Children. We have decided to defer publication on this until related studies are completed (e.g., Fristoe & Kienapple, in preparation; Goossens', in progress; Karlan, in planning; Karlan & Lloyd, in progress; Lloyd & Karlan, in progress). Also see comments for II-E.

III-B-1 Enhancement of Iconicity (pp. 22-23): Normal Children. We decided to eliminate this phase normal subjects.

III-B-2 Enhancement of Iconicity (pp. 22-23): Clinical Children.
Karlan & Lloyd, in progress
Karlan (in planning stage)

III-C Other Strategies (p. 23): Clinical Children. This phase eliminates normal children and adults because it will expand and build on the previous studies.
Creekmore, 1981
Creekmore & Lloyd, in preparation
Karlan, Brenn-White, Lentz, Hudor, Egger & Frankhoff, 1982
Wetherby, Karlan & Spradlin, 1983

In addition to its many research goals, this grant is also serving to provide an opportunity to train graduate students and highly qualified undergraduates in the area of research. Exposure to various research designs is provided, as well as direct involvement and participation with data collection and data analysis. It is felt that through working on this grant, the students will develop the necessary skills needed to conduct independent research in the future. (See Table 1.)

As successive studies are designed and carried out, results will help determine the areas of nonspeech communication toward which further research efforts will be directed. For a discussion of the major

Table 1: Graduate students benefiting from research training as a result of this nonspeech research project. This includes graduate research assistants and other graduate students who were involved without direct financial support from the grants. This does not include nine Undergraduate Research Trainees (URT's) who were supported by Education at Purdue and who worked with Lloyd and/or Karlan during the project period.

| AUDIOLOGY AND SPEECH SCIENCE | EDUCATIONAL PSYCHOLOGY | SPECIAL EDUCATION |
|---|---|---|
| *Bristow, M.S., 1980 | Luftig, Ph.D., 1980# | Creekmore, Ph.D., 1981# |
| *Daniloff (Kelsh), M.S., 1980# | | Doherty, Ph.D. --- # |
| Keinapple, M.S., --- | | **Fiocca, M.A., 1981 |
| *Langlois, M.S., 1982 | | Gauthier, Ph.D., 1980# |
| *Page, Ph.D., 1981# | | *Gerard, Ph.D., --- |
| | | *Goossens', Ph.D., --- |
| | | Lonergan, M.S., --- |
| | | Paris, M.S., 1982 |

*Thesis or dissertation completed or in progress in the area of nonspeech communication.

**Thesis completed at the University of Illinois under the direction of Karlan, while he was a consultant on the project.

---Degree in progress.

#Authorship of one or more journal articles in the area (includes articles in press, but excludes published abstracts and papers submitted).

areas in need for major research efforts in the future the reader is referred to the recent IASSMD plenary session paper (Lloyd & Karlan, 1982/1983)

DISSEMINATION

Dissemination has been one of the major activities associated with this grant. The previous sections of this report cite the major papers presented as a direct result of the research conducted through this grant. It should also be noted that copies of preprints, proposals, publications, achievement lists, and reference lists have been sent to individuals throughout the United States as well as to many other countries. Many requests for reprints have been received. Purdue has become widely recognized as a source for information about nonspeech communication and members of the grant staff frequently give talks on topics in this area with particular emphasis being placed on research endeavors. In addition to the above papers, the most recent dissemination efforts have included invited addresses by Fristoe (1979) at Adelphi University, Lloyd (1980a) at IALP and McGraw (1981) at the annual convention of the North Carolina Speech, Hearing and Language Association. Responses to other invited addresses, shortcourses at conventions and conference presentations continue to be developed.

The primary method of dissemination of research grants is through refereed journals and other publications. Using this as a standard the grant has been highly productive (see number of citations in reference list at the end of this report). A second major avenue of dissemination for research grants is the presentation at professional meetings. By this standard the grant has also been highly productive. During the three years of the grant Lloyd, Fristoe, and Karlan have made numerous presentations at state, regional, national, and international meetings. As a direct (or indirect) result of the research conducted on this grant one or more presentations were made at the national and international meetings summarized as follows (asterisk indicates published papers and/or abstract listed in references):

1. American Association of Mental Deficiency, 1979, 1980, 1981
2. American Psychological Association, 1980
3. American Speech and Hearing Association, 1979, 1980, 1981, 1982*
4. Association for the Severely Handicapped, 1981
5. Council for Exceptional Children, 1980, 1982
6. XVIIIth International Congress of Logopedics and Phoniatrics, Washington, D.C., 1980*
7. Gatlinburg Conference on Research and Mental Retardation/ Developmental Disabilities (1982)
8. 1980 International Workshop on Special Education, Taipei, Taiwan, 1980
9. Second International Conference on Nonspeech Communication, Toronto, Canada, 1982*

10. VIth International Congress of International Association for the Scientific Study of Mental Deficiency, Toronto, Canada, 1982*

In addition to these regular convention presentations during the grant period, the following major national and international presentations were made: one ASHA short course (Goossens' & Lloyd, 1981); one international discussant presentation (Lloyd, 1981); invited comments at the major plenary session at the IALP congress (Lloyd, 1980); a plenary session paper at the IASSMD congress (Lloyd & Karlan, 1982); invited presentations at the Second International Conference on Nonspeech Communication (Karlan, 1982: Lloyd, 1982a, 1982b), and a major invited address at the 1980 International Workshop on Special Education (Lloyd, 1980). Additional international presentations including, in part, research from this project were made at the University of Pretoria and the University of Witwatersrand in August of 1981 and at three different cities in Spain (Sevilla, Madrid, and Bilbao) in May of 1982.

Through this research project a number of graduate students in audiology and speech science, in educational psychology and in special education have become actively involved in this area of research (see Table 1). These students have also made numerous presentations at state, regional, and national conventions, and have been actively involved in preparation of publications. In addition two students made major invited presentations at the Second International Conference on Nonspeech Communication in Toronto (Gerard & Lageer, 1982; Goossens', 1982).

It should be noted that most of the travel expenses for the above presentations were covered by sources other than grant funds (e.g.,funds from host organizations, Purdue University funds, Special Education Discretionary Fund, personal funds).

In addition to the more formal dissemination (e.g., publications and presentations) there is a very important informal network of dissemination through communication of correspondence and personal contact with those actively involved in the area of research. During the period of this grant there has been a considerable number of requests for our papers and other similar communication about our work. In an attempt to further facilitate such informal communication and disseminate information about the current research project we have sent a dear colleague letter (see Appendix A) including a listing of our papers (both published and unpublished) that are available upon request. This mailing of the "Dear Colleague" letter at the conclusion of the grant was sent to a list of over 725 individuals. This list was generated from six sources as follows: those who had requested our papers during the past three years, 1980 and 1981 participants in the Cascade Institutes on "Meeting the Communication Needs of the Severely Handicapped," the Asha Ad Hoc Committee on Communication Processes and Non-speaking Persons, the ASHA special interest group on non-vocal communication, the ASHA special interest group on mental retardation and developmental disabilities.

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APPENDIX A

PURDUE UNIVERSITY SPECIAL EDUCATION

November 30, 1982

Dear Colleague:

We have just competed a three-year research project in the area of nonspeech communication funded by the Special Education Program of the U. S. Department of Education (Grant Number G007902256). As a part of our dissemination activities, we would like to share with you the enclosed listing of our papers supported through this grant for the three-year period as well as other papers developed during the first five years of establishing an active research program in the area of nonspeech communication here at Purdue. If you are interested in receiving copies of any of the papers with a blank listed to the left of the citation, please advise.

We would appreciate receiving a listing of your published and unpublished papers (including convention presentations) on this topic. We believe we have one of the largest collection of papers on nonspeech communication and would like very much to check your list of papers against our files.

I wish to call your attention to the announcement of page 9 of our list of papers. This summer we will be offering a special two-week institute (June 13-24) and two full summer session courses (June-August) on nonspeech communications. Please share this information with your colleagues.

Although we have all seen some limitations in federal and state funding, I am pleased to report that we anticipate having assistantship money available next year for doctoral students who have had some practical clinical and/or educational experience and now wish to pursue a research oriented doctoral degree. Please share this information with potential doctoral students.

Thank you in advance for information about your papers and for spreading the word that we are attempting to recruit strong doctoral students for our nonspeech program

Cordially,

Lyle L. Lloyd, Ph. D.
Professor and Chairman of
Special Education and
Professor of Audiology and
Speech Sciences

LLL:pc

cc: M. Fristoe
G. R. Karlan

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## NON-SPEECH PAPERS

The following reference list covers all theses, dissertations, abstracts and publications in the area of non-speech communication by Drs. Fristoe, Karlan and Lloyd and their students from 1977 to the present. Papers at conventions, research meetings and workshops are listed only if the paper and/or abstract are published in a journal and/or proceedings. Reprints and/or pre-prints of the publications listed with a blank to the left are available by contacting the authors as listed below. Copies of other items such as Asha abstracts, theses and dissertations should be obtained directly from the journals and/or interlibrary loan.

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Footnotes

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**The preparation of these papers was in part supported by a personnel preparation (special project) grant from the Office of Special Education, U.S. Department of Education (#G007901347). Project Co-directors: M. Fristoe and L.L. Lloyd.

***The work reported in this paper was in part supported by a research grant from the Office of Special Education, U.S. Department of Education (#G008001903). Project Directors: L.L. Lloyd and N.N. Creekmore.

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A Summer Smorgasbord of Offerings on
MEETING THE COMMUNICATION NEEDS OF THE SEVERELY HANDICAPPED:
ALTERNATIVE AND AUGMENTATIVE APPROACHES

ED/AUS 528 Nonspeech Communication (3 credits) Instructors: Lyle L. Lloyd and George R. Karlan. This two-week institute has class sessions scheduled from 8:00 a.m. to 12:00 noon, Monday through Friday, June 13 to 24

ED 662 Advanced Practicum in Assessment and Intervention Strategies (3 credits) Instructors: George R. Karlan and Jane E. Doherty. The practicum is scheduled for hours to be arranged each Tuesday during the Summer Semester starting on June 14 and ending on August 2 with other hours to be arranged.

AUS 616/ED 667 Seminar on Meeting the Communication Needs of the Severely Handicapped (3 credits) Instructors: Lyle L. Lloyd and George R. Karlan. This seminar will be scheduled to meet for hours to be arranged each Thursday starting on June 16 and going through July 28.

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A Joint Project of Audiology and Speech Sciences and of Special Education